Missouri Department of Natural Resources

Biological Assessment Report

Springfield Urban Streams
Clear Creek,
Jordan Creek, Wilson Creek, and Galloway Creek
Greene County

March 2007

Prepared for:

Missouri Department of Natural Resources
Division of Environmental Quality
Water Protection Program
Water Pollution Control Branch

Prepared by:

Missouri Department of Natural Resources
Field Services Division
Environmental Services Program
Water Quality Monitoring Section

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1.0 Introduction

At the request of the Water Protection Program (**WPP**), the Environmental Services Program's (**ESP**) Water Quality Monitoring Section (**WQMS**) conducted an urban stream biological, water quality, and habitat assessment. The Environmental Services Program chose to conduct a study on urban streams in the Springfield area. The study included Clear Creek, Galloway Creek, Jordan Creek, and Wilson Creek.

On the 2002 303(d) list, 18 miles of Wilson Creek was listed as impaired for unknown toxicity. This section of Wilson Creek however is downstream of the study area. None of the other streams in this study are currently on the 303(d) list of impaired waters. All urban streams however are of concern because of the many potential sources of pollution, especially runoff from impervious urban surfaces, treated lawns, etc.

1.1 Purpose

The purpose of this study was to determine if the aquatic life protection designated use of Springfield urban streams was supported.

1.2 Objectives

- Determine if the macroinvertebrate communities of selected Springfield urban streams are impaired.
- Determine the habitat characteristics of selected Springfield urban streams.
- Define the water quality characteristics of selected Springfield urban streams.

1.3 Tasks

- Conduct biological assessments of the macroinvertebrate communities Clear Creek, Jordan Creek, Wilson Creek, and Galloway Creek in the Springfield area.
- Conduct habitat assessments of Clear Creek, Jordan Creek, Wilson Creek, and Galloway Creek in the Springfield area.
- Conduct water quality assessments of Clear Creek, Jordan Creek, Wilson Creek, and Galloway Creek in the Springfield area.

1.4 Null Hypotheses

- Macroinvertebrate assemblages are similar among Clear Creek stream segments.
- Macroinvertebrate assemblages are similar between Clear Creek and biocriteria reference streams.
- Habitat quality is similar among Clear Creek stream segments.
- Macroinvertebrate assemblages are similar between Clear Creek, Jordan Creek, Wilson Creek, and Galloway Creek in the Springfield area and biocriteria reference streams.

- Habitat quality is similar between Clear Creek, Jordan Creek, Wilson Creek, and Galloway Creek in the Springfield area and biocriteria reference streams.

2.0 Study Area

This study included streams representing two Ecological Drainage Units (**EDU**). An EDU is a region in which biological communities and habitat conditions can be expected to be similar.

Clear Creek, in the Ozark/Osage EDU, begins just northwest of Springfield near the Springfield/Branson National Airport and flows northwest to its confluence with the Sac River approximately two miles west-northwest of Bois D' Arc Conservation Area. Two sites were surveyed on Clear Creek.

Jordan Creek, Wilson Creek, and Galloway Creek, in the Ozark/White EDU, were also assessed at one station per stream. Jordan Creek begins in downtown Springfield and flows southwest to its confluence with Fassnight Creek in southwest Springfield where it becomes Wilson Creek. Wilson Creek briefly flows west and then predominantly south to its confluence with the James River just south of Wilson Creek National Battlefield. Galloway Creek begins in southeast Springfield and flows south to where it joins the James River at the upper end of Lake Springfield. Galloway Creek receives water from a cave spring approximately one mile upstream of the sampling station.

According to Chapter 7 of the State of Missouri Water Quality Standards (10 CSR 20-7.031), all four streams are designated class "P" (revised for Wilson Creek). Beneficial use designations for all four streams are "livestock and wildlife watering and protection of warm water aquatic life and human health—fish consumption".

See Appendix A for a map of EDUs and the 14-digit Hydrologic Units (**HU**) that contain the sampling reaches for Clear Creek, Jordan Creek, Wilson Creek, and Galloway Creek. See Table 2 for a comparison of land use for the EDUs and the 14-digit HUs.

2.1 Water Quality Concerns

2.1.1 Clear Creek

Clear Creek is heavily spring influenced. These springs are part of underground systems that connect with sinkholes. In 2005, a Springfield man, prosecuted by the Missouri Attorney General's Office (**MoAGO**), pleaded guilty to dumping a 50,000 gallon mix of water and spoiled molasses the previous year into a sinkhole (MoAGO 2005). That incident resulted in a fish kill on another landowner's property by water from two springs that received the dumped molasses. Water from these springs eventually runs into Clear Creek. Because of the nature of the sinkhole and spring relationship in its watershed and its proximity to an urban area, Clear Creek will remain vulnerable to intentional and unintentional sources of pollution. Other potential pollution sources nearby are the

Springfield/Branson National Airport, land application of domestic wastewater and biosolids, and other industrial sources (MDNR 2004).

2.1.2 Jordan, Wilson, and Galloway Creeks

The drainages for Jordan, Wilson, and Galloway Creeks are within the city limits of Springfield, thus leaving them vulnerable to the typical sources of urban runoff pollution. Among the potential urban pollutants are road salt, automobile fluids, lawn fertilizers, and pesticides. One other group of pollutants that makes their way into urban waterways is polycyclic aromatic hydrocarbons (**PAHs**) that are common in asphalt surfaces (USGS, 2005). Urban stream quality problems are also typically compounded by increased areas of impervious surfaces in their watersheds that cause runoff to flow at a faster rate into the streams and carry more pollutants.

The city of Springfield is required to prepare annual reports for their National Pollutant Discharge Elimination System (**NPDES**) Municipal Separate Storm Sewer System Permit. This report includes a biological assessment where macroinvertebrate communities at all three streams were determined to be impaired (City of Springfield, 2007).

2.2 Site Descriptions

Sample stations were located in Greene County (see maps, Appendix A). The average width and discharge measurements in cubic feet per second (**cfs**) are given for each sampling station in Table 1. Sampling occurred approximately two months after a major ice storm and many of the streams in the area had large amounts of fallen tree debris. For this study it mostly affected the Clear Creek and Jordan Creek stations. The property owners at Clear Creek #1 had cleared out most of the debris by the time of our sampling date.

Clear Creek Station #1 (NE ¼ sec. 33, T. 30 N., R. 23 W.) is located just downstream of Farm Road 84 one mile east of Bois D' Arc Conservation Area. This site appeared to have much less algae and silt than the upstream station. The bottom was predominantly cobble, gravel, and some bedrock. Large quantities of Trichoptera larvae, particularly Glossostomatids, were observed on the underside of the cobble and gravel. Geographic coordinates at the upstream terminus are Latitude 37.29064º, Longitude –93.46320º.

Clear Creek Station #2 (SW ¼ sec. 4, T. 29 N., R. 23 W.) is located on private property just west-northwest of the Springfield/Branson National Airport. This site is influenced by two springs. At the upstream terminus of the sampling segment was Jim Crook Spring and approximately ⅔ the distance downstream on the segment is Hazeltine Spring. This site had considerable silt and algae in the bottom of the stream and below Hazeltine Spring was an abundance of watercress. Geographic coordinates at the upstream terminus are Latitude 37.25397º, Longitude –93.43758º.

Galloway Creek (sec. 16, T. 28 N., R 21 W.) is located just upstream of the Highway 60 crossing in southeast Springfield. The substrate was mostly loose cobble and gravel with some sedimentation. Approximately ¼ to ⅔ of the downstream facing right bank was railroad riprap. Geographic coordinates at the downstream terminus are Latitude 37.13036º, Longitude –93.23431º.

Jordan Creek (sec. 27, T. 29 N., R. 22 W.) is located just upstream of the Bennett Street crossing in west Springfield. The stream at this station passes through a solid waste transfer station. The substrate included gravel, cobble, sand, silt, and some hard clay. Geographic coordinates at the downstream terminus for this station are Latitude 37.19012º, Longitude –93.32423º.

Wilson Creek (NW ¼, SW ¼ sec. 29, T. 39 N., R. 22 W.) is located just upstream of Farm Road 146 just west of Springfield. Most of the lower end of this sample station, approximately ⅔ of the length, had the riparian zone cleared of trees for what appeared to be new development of the area and much of the bank was eroded. Above that, the riparian zone appeared to still be intact. The substrate at this station was mostly loose gravel and cobble with some hard clay. Geographic coordinates at the downstream terminus for this station are Latitude 37.18867º, Longitude –93.36548º.

Table 1
Physical Characteristics of the Stations

Station	Ave. Width (feet)	Flow (cfs)
Clear Creek #1	26	10.4
Clear Creek #2	18	4.0
Galloway Creek	21	7.5
Jordan Creek	30	5.8
Wilson Creek	26	14.6

3.0 Methods

Sampling was conducted on March 21 and 22, 2007 by Brian Nodine and Ken Lister of ESP. Sampling consisted of macroinvertebrate collection, stream habitat assessment (see 3.1.2), and water quality sampling.

3.1 Habitat

3.1.1 Land Use

Land cover data were derived from the Thematic Mapper satellite data from 2001-2004 and interpreted by the Missouri Resource Assessment Partnership (**MoRAP**). See Section 2.0 and Table 2 for land use information.

3.1.2 Habitat Assessment

A standardized habitat procedure for Riffle/Pool stream types was followed in the Stream Habitat Assessment Project Procedure (**SHAPP**) (MDNR 2003b). For comparison, a habitat assessment at the Pomme de Terre River biological criteria reference (**BIOREF**) station at Highway 65 was conducted during the sample period.

3.2 Physicochemical Data Collection and Analysis

At each sampling station, *in situ* water quality measurements were collected for temperature (°C), dissolved oxygen concentration (mg/L), conductivity (µS/cm), and pH. These measurements followed Standard Operating Procedures MDNR-FSS-101 Field Measurement of Water Temperature (MDNR 1993), MDNR-WQMS-103 Sample Collection and Field Analysis for Dissolved Oxygen Using a Membrane Electrode Meter (MDNR 2002b), MDNR-FSS-102 Field Analysis for Specific Conductance (MDNR 2000a), and MDNR-FSS-100 Field Analysis of Water Samples for pH (MDNR 2001a), respectively. Additionally, water samples were collected and submitted to the ESP's Chemical Analysis Section for analyses of chloride, total phosphorus, ammonia-N, nitrate + nitrite-N, and total nitrogen. Turbidity (NTU) was analyzed by the WQMS.

Stream discharge in cubic feet per second (**cfs**) was measured at each sampling station using a Marsh-McBirney Flo-Mate Model 2000. Discharge was calculated per the methods in the Standard Operating Procedure MDNR-FSS-113 Flow Measurement in Open Channels (MDNR 2001b).

Physicochemical data were summarized and presented in tabular form.

3.3 Macroinvertebrate Collection and Analysis

A standardized sample collection procedure was followed as described in the Semi-quantitative Macroinvertebrate Stream Bioassessment Project Procedure (**SMSBPP**) (MDNR 2003a). Three standard habitats, coarse substrate (**CS**), non-flowing water with depositional substrate (**NF**), and rootmat (**RM**) at the stream edge, were sampled at all locations.

A standardized sample analysis procedure was followed as described in the SMSBPP. The SMSBPP provides details on the calculation of metrics and scoring of the multi-metric Macroinvertebrate Stream Condition Index (**MSCI**). The following four metrics were used: 1) Taxa Richness (**TR**); 2) total number of taxa in the orders Ephemeroptera, Plecoptera, and Trichoptera (**EPTT**); 3) Biotic Index (**BI**); and 4) Shannon Diversity Index (**SDI**).

Macroinvertebrate data were analyzed by comparing Clear Creek data to biological criteria for the Ozark/Osage EDU and comparing the data from the other three

Springfield streams to biological criteria for the Ozark/White EDU. A longitudinal comparison between the two Clear Creek sites was also made. See Tables 6 and 7 for biological criteria for warm water reference streams in the Ozark/Osage and Ozark/White EDUs.

4.0 Quality Assurance/Quality Control (QA/QC)

QA/QC procedures were followed as described in pertinent Standard Operating and Project Procedures.

5.0 Data Results and Analyses

5.1 Land Use

According to MoRAP land cover files (see Table 2), the watershed land use of Clear Creek is comprised mostly of grassland and forest land. Only four percent of the land usage is listed as urban, however the headwaters of Clear Creek originate near the Springfield/Branson National Airport. Land usage for Galloway Creek is listed as predominantly grassland with urban and forest divided evenly. The predominant land use for Jordan and Wilson Creeks is urban with some grassland and a minor amount of forest and cropland.

Table 2
Percent Land Cover

	14-digit HUC	Urban	Cropland	Grassland	Forest	Wetland	Open Water
Ozark/Osage EDU		2	4	42	44	-	-
Clear Creek	10290106030002	4	5	66	22	0	0
Ozark/White EDU		3	1	37	53	-	-
Galloway Creek	11010002010005	21	5	48	21	0	1
Jordan and Wilson Creeks	11010002020001	50	2	33	11	0	0

5.2 Habitat Assessment

Habitat assessment scores were recorded for each sampling station. Results are presented in Table 3. According to the project procedure guidance, the total score from the physical habitat assessment of the study sites should be at least 75% of the total score of the habitat assessment(s) of the BIOREF station(s) to support a similar biological community. Habitat scores for all five stations met the 75% requirement. It is therefore inferred that, based on habitat scores, all stations should support comparable biological communities.

Table 3
Habitat Scores

BIOREF Stream	Habitat Score	Station	Habitat Score	% of BIOREF
Pomme de Terre	125	Clear Creek #1	150	120
		Clear Creek #2	150	120
		Galloway Creek	120	96
		Jordan Creek	111	89
		Wilson Creek	142	114

5.3 Physicochemical Data

In situ water quality measurements and turbidity are summarized in Table 4. Temperatures were consistent and ranged from 13.0 to 17.0º C.

Conductivity levels were consistent among stations, but ran somewhat higher in the Jordan/Wilson Creek drainage, possibly due to the higher urban influence. Dissolved oxygen levels were consistent between stations and did not fall below the Water Quality Standards minimum concentration for warm-water and cool-water fisheries (5.0 mg/L).

Turbidity levels were consistently low at all stations.

Table 4
In situ Water Quality Measurements and Turbidity at all Stations

Station	Parameter				
	Temp. (ºC)	Diss. O_2 (mg/L)	Cond. (µmhos/cm)	pH	Turb. (NTU)
Clear Creek #1	13.0	9.3	405	8.0	1.6
Clear Creek #2	14.0	7.0	429	7.1	1.0
Galloway Creek	14.0	8.3	476	7.9	3.0
Jordan Creek	16.5	7.0	591	7.7	2.2
Wilson Creek	17.0	7.7	534	7.8	1.3

Nutrient and chloride concentrations are presented in Table 5. All ammonia results were below detectable limits. Total phosphorus levels were all either below detectable limits or barely above with estimated values. Nitrate-nitrite and total nitrogen levels were consistent between all stations. Chloride levels were consistent between Clear Creek stations and between the three other stations. The slightly higher chloride results from Galloway, Jordan, and Wilson Creeks is likely because of the higher urban influence than that received by Clear Creek. All chloride levels were well below chronic criteria for protection of aquatic life and drinking water supply.

Table 5
Nutrient Concentrations at all Stations

Station	Sample #	Parameter (mg/L)				
		NH_3-N	$NO_3 + NO_2$-N	Total N	Total Phos.	Chloride
Clear Creek #1	0704023	<0.03	1.50	1.66	0.01*	14.0
Clear Creek #2	0704022	<0.03	2.10	2.23	<0.01	12.0
Galloway Creek	0704024	<0.03	2.01	2.20	<0.01	37.9
Jordan Creek	0704025	<0.03	1.35	1.64	0.02*	47.0
Wilson Creek	0704026	<0.03	1.73	1.93	0.02*	38.6

*Estimated values

5.4 Biological Assessment

5.4.1 Semi-quantitative Macroinvertebrate Stream Bioassessment Project Procedure (SMSBPP)

The SMSBPP evaluation used biological criteria that were calculated from ESP's database of Wadeable/Perennial Biological Reference Streams for the Ozark/Osage EDU and the Ozark/White EDU. See Biological Criteria for Wadeable/Perennial Streams of Missouri (MDNR 2002a) for more explanation. These criteria are listed for spring season Ozark/Osage EDU and Ozark/White EDU in Tables 6 and 7, respectively. Macroinvertebrate Stream Condition Index sustainability scores of 20-16 qualify as fully sustaining, 14-10 as partially sustaining, and 8-4 as non-sustaining of aquatic life.

Table 6
Biological Criteria for Warm Water Reference Streams
in the Ozark/Osage EDU (Spring Season)

	Score = 5	Score = 3	Score = 1
TR	>90	45-90	<45
EPTT	>26	13-26	<13
BI	<6.20	8.10-6.20	>8.10
SDI	>3.27	1.64-3.27	<1.64

Table 7
Biological Criteria for Warm Water Reference Streams
in the Ozark/White EDU (Spring Season)

	Score = 5	Score = 3	Score =1
TR	>93	46-93	<46
EPTT	>31	16-31	<16
BI	<4.49	7.24-4.49	>7.24
SDI	>3.23	1.61-3.23	<1.61

5.4.2 Comparisons with Regional Reference Streams in Respective EDUs

Macroinvertebrate Stream Condition Indices were calculated for each stream as mentioned in section 5.6.1. The four metrics, total scores, and MSCI sustainability rankings during spring 2007 are presented in Table 8. The only station to receive a fully sustainable ranking was the downstream Clear Creek site.

Table 8
Metric Values and Stream Condition Indices

Station	Sample #	TR	EPTT	BI	SDI	MSCI	Sustainability
Clear Creek #1	0703223	99	25	5.69	3.64	18	**Full**
Clear Creek #2	0703222	52	5	6.21	2.90	10	**Partial**
Galloway Creek	0703224	65	10	6.18	3.10	10	**Partial**
Jordan Creek	0703225	41	4	7.51	2.34	6	**Non**
Wilson Creek	0703226	41	6	6.55	2.33	8	**Non**

5.4.3 Clear Creek Longitudinal Comparison

There is a notable difference between SCI scores and metrics longitudinally on Clear Creek. The most upstream station received an SCI score of only 10 (partially sustainable) while the downstream station received an SCI of 18 (fully sustainable).

5.4.4 Macroinvertebrate Percent and Community Composition

Macroinvertebrate taxa richness, EPT taxa, percent EPT relative abundance, and top five dominant families are presented in Table 9. The percent of relative abundance data were averaged from the sum of the three macroinvertebrate habitats (coarse substrate, depositional non-flow, and rootmat) sampled at each station.

Diptera was the dominant order at all sample stations except at Wilson Creek where Coleoptera at 35% (not shown in the table) was the dominant order. The Diptera family Chironomidae was dominant at all stations except Wilson Creek where Elmidae was the dominant family

Clear Creek taxa richness and EPTT scores were notably higher at the downstream station where EPTT was five times that of the upstream station and taxa richness was almost double that of the upstream station.

Galloway Creek had notably higher total taxa than Jordan and Wilson Creeks and somewhat higher EPTT.

Table 9
Macroinvertebrate Composition (percentages rounded to whole numbers)

Station	Clear Cr. #1	Clear Cr. #2	Galloway Cr.	Jordan Cr.	Wilson Cr.
Taxa Richness	99	52	65	41	41
EPTT	25	5	10	4	6
% Ephemeroptera	20	0	18	7	18
% Plecoptera	4	0	0	0	0
% Trichoptera	5	1	2	2	1
Total EPT %	29	1	20	9	19
% Diptera	50	48	49	59	30
% Top Five Dominant Families					
Chironomidae	48	47	47	50	30
Caenidae	11			6	14
Elmidae	9		4		35
Heptageniidae	7				4
Perlidae	4				
Gammaridae		25			
Planariidae		6			7
Sphaeriidae		4			
Asellidae		3			
Hyalellidae					
Baetidae			16		
Crangonyctidae			14		
Psephenidae			7		
Tubificidae				14	
Physidae				6	
Coenagrionidae				4	

6.0 Discussion

Physicochemical results revealed few definitive trends at all five sample stations.

6.1 Clear Creek

Macroinvertebrate data revealed notable impairment at the upstream Clear Creek station however they did not reveal any notable impairment at the downstream station and tended to indicate a healthy community for its EDU.

A possible cause of the macroinvertebrate community showing impairment at the upstream site is that it is at the most upstream end of the stream where the stream is smaller and in the most direct influence of springs that are potentially affected by any input of pollutants from nearby sinkholes. Sample data and resulting metrics are dominated by Gammarus (306 total, 25% of the overall sample) in the coarse substrate.

These individuals were particularly noticeable in the net from kick samples in the riffle immediately below the downstream spring at that site.

Assuming water quality related impairment, there appears to be a considerable recovery by the time Clear Creek reaches Station #2 just a little over a mile downstream.

6.2 Jordan, Wilson, and Galloway Creeks

Macroinvertebrate community data from all three urban Springfield stations indicate impairment to the designated use. This is particularly evident in Jordan Creek, which originates in the middle of the city. Galloway Creek shows the least impairment, possibly because its watershed is somewhat less urbanized than the Jordan/Wilson Creek drainage.

The impairment is most likely due to the usual urban influences mentioned in section 2.1.2. As also mentioned, previous biological monitoring by the city of Springfield has shown impairment to macroinvertebrate communities in these streams.

7.0 Conclusions

Based on this study, it appears that the headwater section of Clear Creek is impaired but the stream recovers within a relatively short distance. Based on this study, and the city of Springfield study, it can be concluded the three streams draining from within the city limits of Springfield are impaired.

8.0 Recommendations

8.1 Clear Creek

Because the macroinvertebrate community of the upstream site of Clear Creek was impaired and based on the history of illegal dumping into the sinkhole system that recharges springs feeding Clear Creek, every effort to protect these sinkholes should be made as well as the watershed in general. Repeat biological assessments and chemical monitoring should be performed in the future.

8.2 Jordan, Wilson, and Galloway Creeks

Because this study, as well as previous biological assessments, has shown Jordan, Wilson, and Galloway Creeks to be impaired, there is little reason for confidence that further studies will provide different results. To improve and protect the quality and biological integrity of these streams, urban stream best management practices are recommended. Further monitoring that could provide insight into the impairment of these streams would be to conduct sediment analysis, particularly for metals, pesticides, PAHs, and toxicity.

9.0 Summary

- The null hypothesis that macroinvertebrate assemblages are similar between Clear Creek stations is rejected.
- The null hypothesis that macroinvertebrate assemblages are similar between Clear Creek and biocriteria reference streams is accepted for Station #1 and rejected for Station #2.
- The null hypothesis that habitat quality is similar between Clear Creek stations is accepted.
- The null hypothesis that macroinvertebrate assemblages are similar between Clear Creek, Galloway Creek, Jordan Creek, and Wilson Creek in the Springfield area and biocriteria reference streams is rejected.
- The null hypothesis that habitat quality is similar between Clear Creek, Galloway Creek, Jordan Creek, and Wilson Creek in the Springfield area and biocriteria reference streams is accepted.

10.0 Literature Cited

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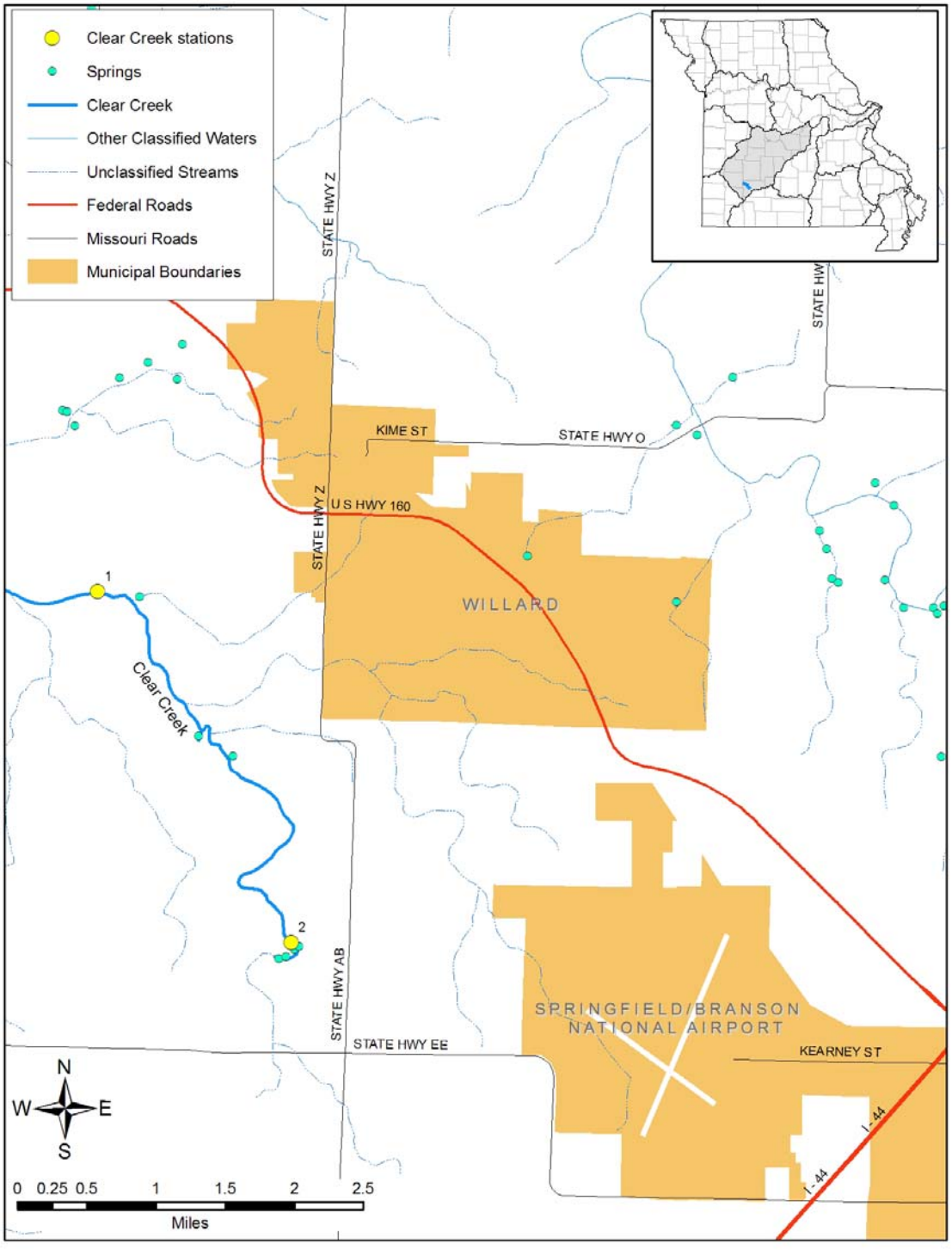
Appendix A

Maps

Clear Creek
Ozark/Osage Ecological Drainage Unit (EDU)

Jordan, Wilson, and Galloway Creeks
Ozark/White EDU


Clear Creek stations
Springs
Clear Creek
Other Classified Waters
Unclassified Streams
Federal Roads
Missouri Roads
Municipal Boundaries
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STATE HWY O
KIME ST
U S HWY 160
WILLARD
Clear Creek
1
2
STATE HWY AB
STATE HWY EE
SPRINGFIELD/BRANSON
NATIONAL AIRPORT
KEARNEY ST
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W
E
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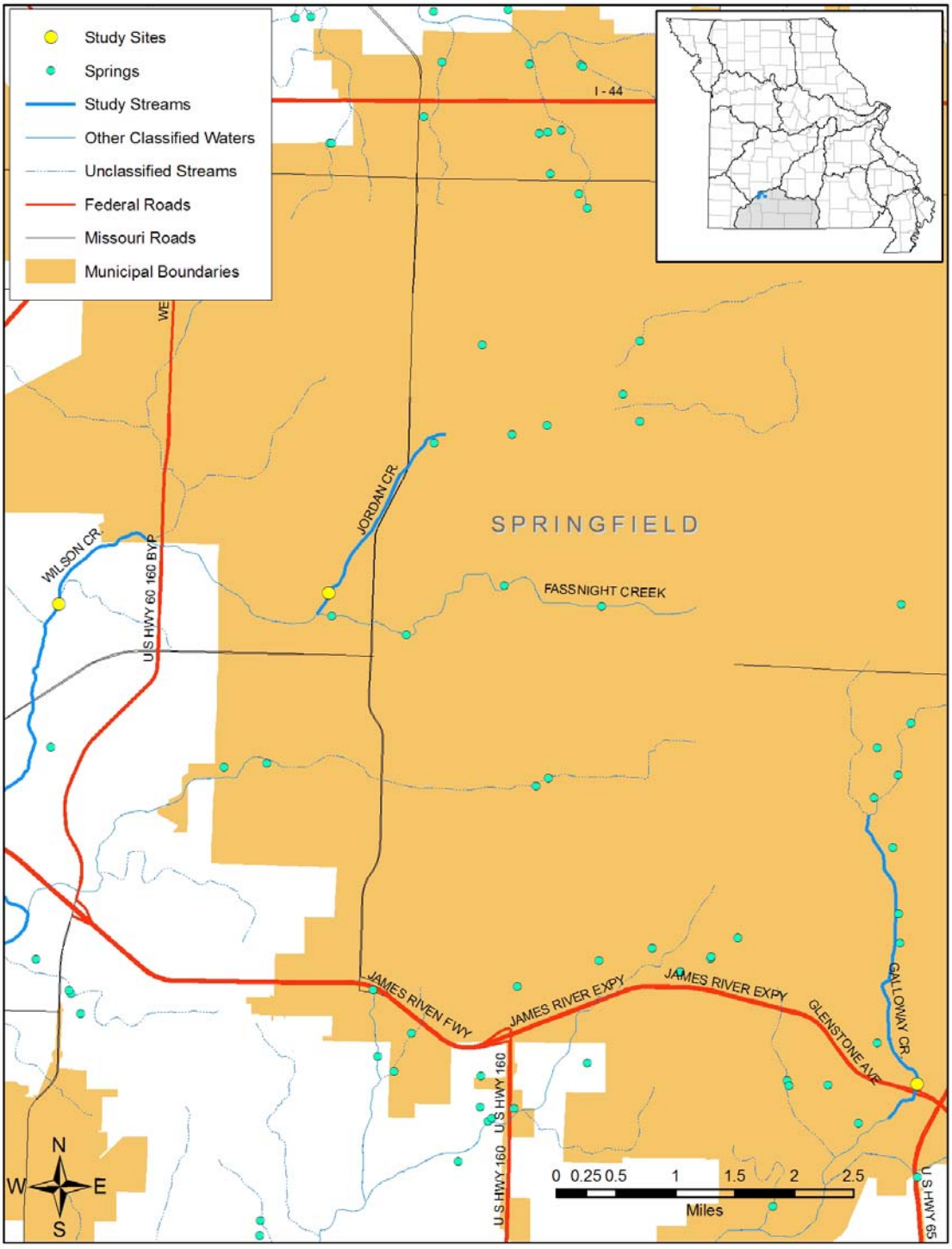
Miles


Study Sites
Springs
Study Streams
Other Classified Waters
Unclassified Streams
Federal Roads
Missouri Roads
Municipal Boundaries
I - 44
SPRINGFIELD
JORDAN CR
WILSON CR
U S HWY 60 160 BYP
FASSNIGHT CREEK
JAMES RIVEN FWY
JAMES RIVER EXPY
JAMES RIVER EXPY
GLENSTONE AVE
GALLOWAY CR
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Miles

Appendix B

Macroinvertebrate Bench Sheets

Aquid Invertebrate Database Bench Sheet Report
Clear Ck [0703223], Station #1, Sample Date: 3/19/2007 3:00:00 PM
CS = Coarse; NF = Nonflow; RM = Rootmat; -99 = Presence

ORDER: TAXA	CS	NF	RM
"HYDRACARINA"			
Acarina	3	5	3
AMPHIPODA			
Crangonyx	2	1	5
Hyalella azteca		1	11
ARHYNCHOBDELLIDA			
Erpobdellidae			-99
COLEOPTERA			
Dubiraphia		8	11
Hydroporus		9	2
Macronychus glabratus	1		1
Optioservus sandersoni	32		1
Paracymus			1
Psephenus herricki	15	2	-99
Scirtidae			1
Stenelmis	62	1	10
DECAPODA			
Orconectes luteus		-99	-99
Orconectes neglectus	-99		
Orconectes virilis		1	-99
DIPTERA			
Ablabesmyia		7	1
Ceratopogoninae	3	13	3
Chironomus		2	
Cladotanytarsus		2	
Clinocera		1	
Corynoneura			6
Cricotopus/Orthocladius	84	26	47
Cryptochironomus	2	8	2
Cryptotendipes		2	4
Dicrotendipes	2	5	11
Eukiefferiella brevicalcar grp	61	3	26
Hemerodromia	2	1	2
Hexatoma	-99		
Hydrobaenus		22	12
Labrundinia			1
Micropsectra		1	12
Microtendipes	6	6	
Natarsia		1	1
Nilotanypus	1		

Aquid Invertebrate Database Bench Sheet Report
Clear Ck [0703223], Station #1, Sample Date: 3/19/2007 3:00:00 PM
CS = Coarse; NF = Nonflow; RM = Rootmat; -99 = Presence

ORDER: TAXA	CS	NF	RM
Parakiefferiella			1
Paralauterborniella		5	1
Paratanytarsus		3	10
Paratendipes		30	1
Pericoma	1		
Polypedilum convictum	23		1
Polypedilum fallax grp	4		1
Polypedilum illinoense grp	1	1	17
Polypedilum scalaenum grp	1		
Potthastia		1	2
Rheocricotopus	3		1
Rheotanytarsus	7	1	18
Simulium	6		
Stempellina		9	
Stempellinella	23	10	7
Stenochironomus			1
Stictochironomus		2	
Synorthocladius			1
Tabanus	-99		
Tanytarsus	14	21	34
Thienemanniella			2
Thienemannimyia grp.	23		11
Tribelos	1	7	
Tvetenia bavarica grp	3		
EPHEMEROPTERA			
Acentrella	3		1
Acerpenna			1
Caenis latipennis	59	80	14
Diphetor	14		1
Ephemera	-99		
Fallceon	2		
Heptageniidae	16	1	1
Hexagenia		2	1
Isonychia bicolor	6		
Leucrocuta	3		
Paraleptophlebia	1	2	1
Stenacron	19	6	1
Stenonema femoratum	1		
Stenonema pulchellum	46	1	1
HEMIPTERA			
Corixidae		1	

Aquid Invertebrate Database Bench Sheet Report
Clear Ck [0703223], Station #1, Sample Date: 3/19/2007 3:00:00 PM
CS = Coarse; NF = Nonflow; RM = Rootmat; -99 = Presence

ORDER: TAXA	CS	NF	RM
Microvelia			1
LIMNOPHILA			
Ancylidae	6	1	
Physella		1	
Planorbidae		1	
LUMBRICINA			
Lumbricina	-99	1	
MESOGASTROPODA			
Elimia	23	1	1
ODONATA			
Argia			3
Calopteryx			4
Enallagma			1
PLECOPTERA			
Acroneuria	-99		
Perlesta	52	2	2
TRICHOPTERA			
Agapetus	4		
Cheumatopsyche	1		
Chimarra	1		
Helicopsyche	7		
Hydroptila	3	2	9
Ochrotrichia	21	2	8
Pycnopsyche	-99	1	2
Rhyacophila	1		
Triaenodes			3
TRICLADIDA			
Planariidae	4		
TUBIFICIDA			
Branchiura sowerbyi	1	3	
Enchytraeidae		1	1
Limnodrilus hoffmeisteri		4	2
Tubificidae	5	10	
VENEROIDEA			
Corbicula	16		6

Aquid Invertebrate Database Bench Sheet Report
Clear Ck [0703222], Station #2, Sample Date: 3/19/2007 12:30:00 PM
CS = Coarse; NF = Nonflow; RM = Rootmat; -99 = Presence

ORDER: TAXA	CS	NF	RM
"HYDRACARINA"			
Acarina	8		1
AMPHIPODA			
Gammarus	306	1	1
Hyalella azteca		1	3
COLEOPTERA			
Hydroporus		7	15
Optioservus sandersoni	31		
DIPTERA			
Ceratopogoninae		4	3
Chironomus		7	
Clinocera	1		1
Corynoneura	2	1	5
Cricotopus/Orthocladius	94	21	6
Diamesa	5		
Dicrotendipes		4	1
Eukiefferiella	18		1
Hydrobaenus		3	8
Larsia		8	
Micropsectra	5	47	77
Natarsia	2	6	1
Parametriocnemus	1	1	
Paratendipes		47	17
Phaenopsectra			1
Polypedilum		1	
Polypedilum scalaenum grp	2		1
Potthastia		1	1
Procladius			3
Simulium	3		
Stempellinella		2	3
Stictochironomus		5	2
Tanytarsus	1	23	28
Thienemanniella	64	8	12
Thienemannimyia grp.	8	4	6
Tvetenia bavarica grp	8		2
Zavrelimyia		2	3
EPHEMEROPTERA			
Diphetor	1		2
ISOPODA			
Lirceus	32	1	

Aquid Invertebrate Database Bench Sheet Report
Clear Ck [0703222], Station #2, Sample Date: 3/19/2007 12:30:00 PM
CS = Coarse; NF = Nonflow; RM = Rootmat; -99 = Presence

ORDER: TAXA	CS	NF	RM
LIMNOPHILA			
Menetus		3	15
Physella	1	10	6
LUMBRICINA			
Lumbricina	12	3	
LUMBRICULIDA			
Lumbriculidae	11	8	2
MEGALOPTERA			
Nigronia serricornis	-99		
Sialis		1	-99
MESOGASTROPODA			
Elimia	3		6
ODONATA			
Argia	1		
Ischnura			4
TRICHOPTERA			
Agapetus	1		
Ochrotrichia	5		
Oxyethira	2	1	
Ptilostomis		-99	
TRICLADIDA			
Planariidae	37	11	26
TUBIFICIDA			
Ilyodrilus templetoni		2	3
Limnodrilus hoffmeisteri		1	
Tubificidae		8	7
VENEROIDEA			
Sphaeriidae	2	40	8

Aquid Invertebrate Database Bench Sheet Report
Jordan Ck [0703225], Station #1, Sample Date: 3/22/2007 12:30:00 PM
CS = Coarse; NF = Nonflow; RM = Rootmat; -99 = Presence

ORDER: TAXA	CS	NF	RM
"HYDRACARINA"			
Acarina	4	1	
AMPHIPODA			
Crangonyx	15	4	21
ARHYNCHOBDELLIDA			
Erpobdellidae		-99	
DECAPODA			
Orconectes virilis			-99
DIPTERA			
Ablabesmyia		7	10
Chironomus			1
Cricotopus bicinctus	2		
Cricotopus/Orthocladius	266	57	62
Cryptochironomus	1	6	
Dasyheleinae	1	1	
Diamesa	3		1
Dicrotendipes	1	5	11
Diptera	1	89	3
Eukiefferiella		1	
Hydrobaenus		1	1
Ormosia	1		
Phaenopsectra			1
Polypedilum convictum	2		
Polypedilum illinoense grp		2	7
Polypedilum scalaenum grp	1	2	
Pseudosmittia		1	
Thienemannimyia grp.	28	8	18
EPHEMEROPTERA			
Caenis latipennis	4	12	51
Stenonema femoratum	1	1	-99
LIMNOPHILA			
Ancylidae		2	7
Fossaria			1
Menetus			11
Physella	1	4	55
LUMBRICINA			
Lumbricina	7		1
ODONATA			
Argia			8
Calopteryx		1	6

Aquid Invertebrate Database Bench Sheet Report
Jordan Ck [0703225], Station #1, Sample Date: 3/22/2007 12:30:00 PM
CS = Coarse; NF = Nonflow; RM = Rootmat; -99 = Presence

ORDER: TAXA	CS	NF	RM
Enallagma			32
Ischnura			2
PLECOPTERA			
Perlesta		1	
TRICHOPTERA			
Cheumatopsyche	1		1
TRICLADIDA			
Planariidae	3	2	
TUBIFICIDA			
Enchytraeidae	3	7	1
Limnodrilus claparedianus	1	6	
Limnodrilus hoffmeisteri		2	1
Tubificidae	14	101	22
VENEROIDEA			
Sphaeriidae		1	1

Aquid Invertebrate Database Bench Sheet Report
Wilson Ck [0703226], Station #1, Sample Date: 3/22/2007 2:35:00 PM
CS = Coarse; NF = Nonflow; RM = Rootmat; -99 = Presence

ORDER: TAXA	CS	NF	RM
"HYDRACARINA"			
Acarina		1	
AMPHIPODA			
Crangonyx	18	5	
ARHYNCHOBDELLIDA			
Erpobdellidae	1	1	
BRANCHIOBDELLIDA			
Branchiobdellida			1
COLEOPTERA			
Dubiraphia		1	
Stenelmis	258	98	18
DECAPODA			
Orconectes neglectus	-99		
Orconectes virilis			-99
DIPTERA			
Ablabesmyia		2	
Ceratopogoninae		1	
Cricotopus/Orthocladius	73	4	67
Cryptochironomus		7	
Diamesa	28	1	12
Dicrotendipes		4	1
Hydrobaenus	3	5	1
Polypedilum convictum	43		5
Polypedilum illinoense grp	1		2
Polypedilum scalaenum grp	2	14	1
Simulium			7
Tanytarsus		1	1
Thienemannimyia grp.	23	4	11
EPHEMEROPTERA			
Caenis latipennis	26	107	14
Fallceon	4		
Stenacron	1		
Stenonema femoratum	29	6	3
LIMNOPHILA			
Ancylidae	1		
Menetus			1
Physella	1		17
LUMBRICINA			
Lumbricina	1		

Aquid Invertebrate Database Bench Sheet Report
Wilson Ck [0703226], Station #1, Sample Date: 3/22/2007 2:35:00 PM
CS = Coarse; NF = Nonflow; RM = Rootmat; -99 = Presence

ORDER: TAXA	CS	NF	RM
LUMBRICULIDA			
Lumbriculidae	1	9	
ODONATA			
Argia			6
Calopteryx			4
TRICHOPTERA			
Cheumatopsyche	4		1
Chimarra	7		1
TRICLADIDA			
Planariidae	72	1	3
TUBIFICIDA			
Branchiura sowerbyi		1	
Enchytraeidae		1	
Limnodrilus hoffmeisteri		4	1
Tubificidae		9	
VENEROIDEA			
Corbicula		1	
Sphaeriidae		2	1

Aquid Invertebrate Database Bench Sheet Report
Galloway Ck [0703224], Station #1, Sample Date: 3/22/2007 10:30:00 AM
CS = Coarse; NF = Nonflow; RM = Rootmat; -99 = Presence

ORDER: TAXA	CS	NF	RM
"HYDRACARINA"			
Acarina	1		
AMPHIPODA			
Crangonyx	36	49	102
Hyalella azteca		2	
Stygobromus	2	5	
ARHYNCHOBDELLIDA			
Erpobdellidae	-99	1	
COLEOPTERA			
Dubiraphia			1
Dytiscidae		1	
Hydroporus		1	1
Optioservus sandersoni		1	
Psephenus herricki	87	8	2
Stenelmis	37	11	
DECAPODA			
Orconectes neglectus	2	-99	
DIPTERA			
Ablabesmyia		8	4
Brillia			2
Ceratopogoninae		1	
Clinocera	1		
Corynoneura	7	3	7
Cricotopus/Orthocladius	43	3	21
Cryptochironomus		2	
Diamesa	23		
Dicrotendipes	2	4	6
Diptera	17	3	4
Eukiefferiella brevicalcar grp	86		3
Hydrobaenus	2	20	19
Microtendipes		3	1
Nilotanypus	2		
Parakiefferiella			1
Parametriocnemus	14	2	
Paratanytarsus	1	2	1
Paratendipes		53	1
Pericoma		1	
Polypedilum		1	
Polypedilum convictum	39		
Polypedilum fallax grp			1

Aquid Invertebrate Database Bench Sheet Report
Galloway Ck [0703224], Station #1, Sample Date: 3/22/2007 10:30:00 AM
CS = Coarse; NF = Nonflow; RM = Rootmat; -99 = Presence

ORDER: TAXA	CS	NF	RM
Polypedilum illinoense grp		3	3
Polypedilum scalaenum grp	1	7	
Procladius		1	
Pseudochironomus		1	
Rheotanytarsus			1
Simulium	4		1
Stempellinella	16	20	
Tanytarsus	23	33	64
Thienemanniella	3		
Thienemannimyia grp.	43	6	14
EPHEMEROPTERA			
Baetis	20		
Caenis latipennis		1	
Fallceon	175		11
Heptageniidae	2		
Procloeon			1
Stenacron	2	2	
Stenonema femoratum	9	6	6
ISOPODA			
Lirceus			1
LIMNOPHILA			
Ferrissia		1	
Menetus	1	1	
Physella		2	6
LUMBRICINA			
Lumbricina	1	2	
ODONATA			
Argia	1		
Calopteryx			1
TRICHOPTERA			
Cheumatopsyche	14		
Chimarra	11		
Hydroptila		1	
TRICLADIDA			
Planariidae	21	5	2
TUBIFICIDA			
Enchytraeidae		3	
Tubificidae		3	1
VENEROIDEA			
Sphaeriidae	7	6	